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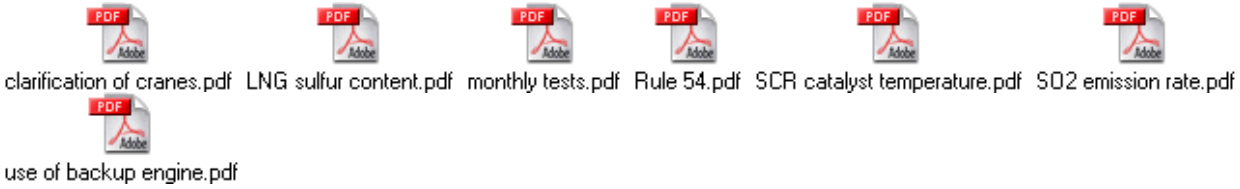
cc Joseph Lapka/R9/USEPA/US@EPA, Gerardo Rios/R9/USEPA/US@EPA, Nahid Zoueshtiagh/R9/USEPA/US@EPA
bcc
Subject Questions from EPA about Cabrillo Port Air Permit Application

In reviewing the application, EPA Air Permits Office has several questions.

Attached are PDF files with EPA questions about the Cabrillo Port air application, placed in context of the air application so that it is easier for BHP to understand the questions being asked by EPA.



The questions are in "balloons" in the pdf documents. For your convenience in providing answers, I have also numbered and included the questions again below:

1. Pages 2-10 and 3-4 (Filename:clarificatino of cranes.pdf): Page 2-10 says that diesel will be used to operate a crane onboard the FSRU. However, page 3-4 says that the cranes used for material handling will be electric. Please clarify what types of cranes will be used.

2. Table FSRU 5: Wartsila 9L50DF Controlled Emissions Summary (filename LNG sulfur content.pdf): Is this 1 ppm by weight or volume?

3. Page 2-10 (filename:monthly tests.pdf): The application says that diesel will be used in monthly tests of the power generator and firewater pumps to ensure their continued operability. Since the Wartsila backup generator will potentially have limited use on diesel during emergencies, will monthly testing on diesel also be necessary for this engine?

4. Page 4-11 (filename:Rule 54.pdf): This demonstrates compliance with the 300 ppmv and 10 ppmv limits at the point of discharge but the demonstration is not so clear for the sea level concentrations at the property line. Did BHP model to show that these concentrations would not be exceeded?

Also, contrary to what is indicated in the Cabrillo Port air permit application, the rule does not have separate requirements for point sources and area sources; the requirements of Rule 54(B) apply to all sources. See http://www.arb.ca.gov/drdb/ven/curhtml/r54.pdf.

5. Table FSRU 4: Release Parameters (filename: SCR Catalyst temperature): This indicates that the exhaust temperature for the main generators will be 800 degrees F. What is the minimum temperature at which the SCR catalyst becomes effective?

6. Table FSRU 11: Firewater Pumps Emission Summary (filename SO2 emission rate.pdf): The emission rates in g/hW-hr are the same for the firewater pumps and emergency engine (see next page) except for SO2. Is one of these a typo?

7. Operating Emissions Summary (filename: use of backup engine.pdf): In this table, it appears as though one of the Wartsila engines will specifically be designated as the backup. Please confirm that this means the following:
1) for normal operations, the three main generators will always be used when they are capable of

operating and the backup generator will only be used when one of the three main generators goes down for maintenance.;
2) although all of the Wartsila engines are dual fueled, the backup engine will be the only one that actually fires on diesel during emergency situations (limited to 100 hours per year).

Please let me know when we can expect a reply - and contact me if any clarification is needed.

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exchange protocol, including notification and exchange of ballast water outside the 200-nautical mile limit. During normal operations, the LNG cargo will be constantly shifting as LNG loads are received and natural gas is sent out. To maintain FSRU stability, the LNG inventory changes will be offset by ballast water pumping. Ocean water will be pumped into various ballast tanks, shifted from one tank to another, or discharged back to the ocean. Ballast water will not be chemically treated, and intakes will be sized to minimize entrainment of aquatic organisms.

2.2.11 Natural Gas Odorization

In order to deliver natural gas that is suitable for delivery to the SoCalGas system and consistent with USDOT safety requirements, the natural gas will be odorized prior to entering SoCalGas facilities. Methane gas, which constitutes a minimum of 85 percent of the natural gas sent out from the FSRU, is odorless. An odorant (typically mercaptan liquid) is added so that leaks of natural gas can be detected by its unique sulfur odor. SoCalGas has requested that the odorant be injected offshore prior to entering the risers and subsea pipelines.

2.2.12 Diesel Fuel

The FSRU will be loaded with diesel fuel prior to departure from the fabrication shipyard. That fuel will be used for initial power generation needs during installation and start-up prior to receipt of LNG. After receipt of LNG, the FSRU will be fueled by natural gas from the gas send out line or BOG. After LNG operations have begun, the diesel fuel will be retained as an emergency fuel supply. The diesel fuel will be used in monthly tests of the power generator and firewater pumps to ensure their continued operability, and to operate a diesel crane for material handling. Diesel fuel will be used as a pilot fuel for the power generation internal combustion engines (only 1 percent of total heat input). The diesel fuel storage tank will be topped off approximately once annually. Diesel fuel will be brought on board in re-useable transportable tote containers; the fuel will be transferred into the FSRU storage tank, and the empty totes then will be transferred back to shore. The diesel fuel storage tank will have a capacity of approximately 144,500 gallons. Diesel fuel will be managed in accordance with USEPA and State of California requirements. BHPB will develop and implement a facility-specific Spill Prevention, Control, and Countermeasure Plan (SPCC Plan) as required for DWPA facilities under 40 CFR 112.1(a)(1).

Diesel Storage Tank. Some breathing losses and small amounts of working losses of VOCs will occur from the diesel storage tank. The tank will be kept full but will not be utilized after commissioning except for emergency diesel engine fueling and provision of pilot fuel to the Wartsila engines. The diesel fuel tank will have a capacity of approximately 144,500 gallons.

Electric Cranes. Electro-hydraulic powered cranes will be utilized for material handling and offloading of supplies from the supply boat. The fuel gas compressor, BOG compressor, loading arms, various pumps, heaters, scrubbers, fork lifts, hand trucks, and utility equipment will be powered by electricity generated by the internal combustion (IC) engine generators, and would be exempt from air permitting since electric-powered equipment is not a source of air pollution.

Ammonia Emissions. Some of the ammonia formed from the urea injected upstream of the SCR catalyst to control NO_x from the generator engines will pass the through the process unreacted and escape into the air. This is referred to as "ammonia slip." The ammonia slip emissions from this Project will be limited 1.6 pounds per hour (lb/h) or 10 ppm in the exhaust (corrected to 15 percent oxygen O_2). Ammonia is not a carcinogen, but it can have chronic and acute adverse human health impacts. The nearest sensitive receptor is onshore about 14 miles from the FSRU location. A health risk screening analysis to conservatively estimate the long-term (chronic) non-cancer risk, and short-term (acute) non-cancer risk associated with the maximum ammonia emissions was not required for this Project. However, for CEQA/NEPA purposes, a health risk screening analysis was conducted for this Project, and the results of this analysis are included as Appendix F. The modeling demonstrates that ammonia slip does not present a material health risk.

Marine Vessel Emissions. The mobile source assist marine vessels associated with the Project include the following:

- Two tug/supply boats;
- One crew boat; and
- One LNG carrier.

The crewboat will conduct approximately 2.5 round trips per week. The tug/supply boat will operate once a week to bring supplies to the FSRU and haul black waste from the FSRU back to shore for disposal, and will conduct approximately 2.5 LNG carrier berthings per week. The primary fuel for these vessels will be gasified LNG.

Table FSRU 5: Wartsila 9L50DF Controlled Emissions Summary

SIC	1321		
PROCESS EQPT DESCRIPTION	Dual Fuel ICE generator, Wartsila 50DF		
FUEL TYPE/PROCESS INFO	Scarborough LNG, 99.7% methane, 1 ppm S (with 1% diesel pilot charge, 15 ppm S)		
TOTAL YEARLY PROCESS RATE	110903	MW-hrs	from BHP estimates
HOURLY PROCESS RATE	24.75	MW	from BHP estimates
PROCESS UNITS	PT071	MW-hrs	
HIGHER HEATING VALUE	1007.6	BTU/cf	
OPERATING SCHEDULE	8760	hrs/yr	
HEAT RATE	7239	BTU/KW-hr	Wartsila Spec 0047057-S504, 13 May 05
CONVERSION EFFICIENCY	47.1%	percent	
HEAT INPUT	179.17	mmBTU/hr	
DRY Fd	8713	dscf/mmBTU	USEPA Method 19
EXHAUST FLOW	5.53	mmdscf/hr	

EMITTENT NAME	EMITTENT PPM	CORR FACTOR	CTL EF LBS/UNIT	ACTUAL LBS/YR	ACTUAL TONS/YR	ACTUAL LBS/HR	RATE g/kw-hr	RATE g/bhp-hr
Nitrogen Oxides (as NO_2)	9	1.0000	0.2401	26,624	13.31	5.94	0.109	0.081
Reactive Hydrocarbons (ROC) as CH_4	40	1.0000	0.3711	41,158	20.58	9.19	0.168	0.126
Carbon Monoxide (CO)	20	1.0000	0.3247	36,014	18.01	8.04	0.147	0.110
Sulfur Dioxide (SO_2)	0.034	1.0654	0.0013	141	0.07	0.03	0.0006	0.0004
Particulates (as PM_{10}) (grains/dscf)	0.0044	1.0000	0.1395	15,469	7.73	3.45	0.0633	0.047
Carbon Dioxide (CO_2)	3.84%	1.0000	978.8576	108,558,240	54,279	24,227	444	331
Ammonia Slip (NH_3)	10	1.0000	0.0985	10,929	5.46	2.44	0.045	0.033

Wartsila Emission Factors (BACT)

NO_X = 9 ppm, 0.109 g/kw-hr (Wartsila Spec 0047057-S504, 13 May 05)
VOC = 40 ppm, 0.168 g/kw-hr (Wartsila Spec 0047057-S504, 13 May 05)
CO = 20 ppm, 0.147 g/kw-hr (Wartsila Spec Spec 0047057-S504, 13 May 05)
PM_{10} = 10 mg/m3, 0.0633 g/kw-hr (Wartsila Spec 0047057-S504, 13 May 05)
CO_2 = 444 g/kw-hr (Wartsila Report 4 July 2003)

Pilot Diesel Fuel Usage	35,153	gal/yr

Average generation	110,903	MW-hrs/yr
Maximum generation	216,810	MW-hrs/yr
Average Capacity Factor	51.2%	percent

exchange protocol, including notification and exchange of ballast water outside the 200-nautical mile limit. During normal operations, the LNG cargo will be constantly shifting as LNG loads are received and natural gas is sent out. To maintain FSRU stability, the LNG inventory changes will be offset by ballast water pumping. Ocean water will be pumped into various ballast tanks, shifted from one tank to another, or discharged back to the ocean. Ballast water will not be chemically treated, and intakes will be sized to minimize entrainment of aquatic organisms.

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Rule 54, Sulfur Compounds

Rule 54 limits the concentration of sulfur compounds discharges from a source. For point source exhaust gases, the SO_2 concentration limit is 300 ppmv. For area sources, the ambient SO_2 concentration limit at the fenceline is 0.25 ppmv for 1-hour and 0.04 ppmv for 24-hour averaging times. For point source exhaust gases, the H_2S concentration limit is 10 ppmv. For area sources, the ambient H_2S concentration limit at the fenceline is 0.06 ppmv for 3-minute and 0.03 ppmv for 1-hour averaging times.

Analysis: The main generators and SCVs use natural gas as fuel exclusively. Burning natural gas in the main generators results in a stack gas concentration of 0.30 ppmv SO_2 and nondetectible H_2S. SO_2 stack gas concentration from the SCVs will be at 0.1 ppmv and nondetectible H_2S. The dual fuel generator (when operating on diesel fuel), backup generator, firewater pump, and lifeboat will all produce a maximum stack gas concentration of 0.29 ppmv SO_2 and nondetectible H_2S. They will be operated with diesel fuel with a 15 ppmv sulfur concentration. This analysis demonstrates that all sources of emissions are below the respective 300 ppmv and 10 ppmv limits required by this rule. Detailed calculations of sulfur compound concentrations in stack gas from all equipment onboard the FSRU are included in Appendix A. BHPB is in compliance with Rule 54.

Rule 57.1, Particulate Matter Emissions From Fuel Burning Equipment

Rule 57.1 prohibits discharge of particulate matter emissions into the atmosphere from fuel-burning equipment in excess of 0.12 lb/MMBtu of fuel input. This rule does not apply to internal combustion engines.

Analysis: The generators, firewater pump engine and lifeboat engines are all internal combustion engines and so exempt from the requirements of this rule. The SCVs will be subject to Rule 57.1 and so required to comply with the 0.12 lb/MMBtu particulate limit. However, the SCVs are expected to emit particulate at or below 0.00189 lb/MMBtu heat input. Detailed calculations of particulate matter emissions from the SCVs are included in Appendix A. BHPB is in compliance with Rule 57.1.

Rule 62.1, Hazardous Materials

Rule 62.1 prohibits the discharge of hazardous materials from any source so as to result in concentrations at or beyond the property line in excess of any State, Federal or local standards or emission limits established.

Analysis: as noted in Section 4.1.5 above, BHPB will not trigger any of the federal NESHAPs. BHBP is in compliance with Rule 62.1.

Table FSRU 4: Release Parameters

Release Parameter	Units	Main Gens	Backup Gen	Vaporizers	Emerg. Pump	Emerg. Gen	Life Boat
Fuel	Type	Dual Fuel	Diesel	Gas	Diesel	Diesel	Diesel
Heat Input	mmBTU/hr	179.2	66.3	460.0	5.9	35.8	0.64
Wet Fd Factor	wscf/mmBTU	10,608	10,320	10,610	10,320	10,320	10,320
Oxygen Content	percent	15%	15%	3%	15%	15%	15%
Exhaust Temperature	Deg F	800	800	70	800	800	800
Stack Diameter	inches	68.2	39.4	78.7	10.0	26.0	3.0
Stack Area	sq. ft.	25.36	8.45	33.82	0.55	3.69	0.05
Stack Flow	wscf/min	112,212	40,424	94,976	3,565	21,835	388
Stack Flow	wacf/min	267,780	96,467	95,336	8,507	52,106	926
Stack Velocity	ft/min	10,558	11,411	2,819	15,597	14,132	18,871
Release Height	meters	33	33	35	25	25	1
Release Diameter	meters	1.73	1.00	2.00	0.25	0.66	0.08
Release Velocity	meters/sec	53.6	58.0	14.3	79.2	71.8	95.9
Release Temperature	degrees K	700	700	294	700	700	700

Downwash Dimensions	Units	FSRU Hull
Height	meters	21
Width (min horizontal)	meters	65
Length (max horizontal)	meters	286

Table FSRU 11: Firewater Pumps Emission Summary

SIC	1321		
PROCESS EQPT DESCRIPTION	Firewater Pump, 600 KW		
FUEL TYPE/PROCESS INFO	California diesel, 15 ppm S		
TOTAL YEARLY PROCESS RATE	60	MW-hrs	
HOURLY PROCESS RATE	0.60	MW	from BHP estimates
PROCESS UNITS	PT071	MW-hrs	
HIGHER HEATING VALUE	137030	BTU/gal	USEPA AP-42
OPERATING SCHEDULE	100	hrs/yr	
HEAT RATE	9751	BTU/KW-hr	
CONVERSION EFFICIENCY	35.0%	percent	
HEAT INPUT	5.85	mmBTU/hr	
DRY Fd	9190	dscf/mmBTU	USEPA Method 19
EXHAUST FLOW	0.19	mmdscf/hr	

EMITTENT NAME	EMITTENT PPM	CORR FACTOR	CTL EF LBS/UNIT	ACTUAL LBS/YR	ACTUAL TONS/YR	ACTUAL LBS/HR	RATE* g/kw-hr	RATE g/bhp-hr
Nitrogen Oxides (as NO_2)	326	1.0000	12.3460	741	0.37	7.41	5.600	4.176
Reactive Hydrocarbons (ROC) as CH_4	134	1.0000	1.7637	106	0.05	1.06	0.800	0.597
Carbon Monoxide (CO)	334	1.0000	7.7162	463	0.23	4.63	3.500	2.610
Sulfur Dioxide (SO_2)	0.3	1.0000	0.015	1	0.00	0.01	0.007	0.005
Particulates (as PM_{10}) (grains/dscf)	0.0097	1.0000	0.4409	26	0.01	0.26	0.200	0.149
Carbon Dioxide (CO_2)	4.26%	1.0000	1543.2439	92,595	46	926	700	522
Ammonia Slip (NH_3)								

* USEPA Tier 2 Standards (>560 kw)

NO_X + ROC = 6.4 g/kw-hr

CO = 3.5 g/kw-hr

PM_{10} = 0.2 g/kw-hr

CO_2 = 700 g/kw-hr (AP-42, Table 3.3-1)

Diesel Fuel Usage	4,270	gal/yr

Table FSRU 12: Emergency Generator Emissions Summary

SIC	1321		
PROCESS EQPT DESCRIPTION	Emergency Generator, 4200 KW		
FUEL TYPE/PROCESS INFO	California diesel, 15 ppm S		
TOTAL YEARLY PROCESS RATE	420	MW-hrs	
HOURLY PROCESS RATE	4.20	MW	from BHP estimates
PROCESS UNITS	PT071	MW-hrs	
HIGHER HEATING VALUE	137030	BTU/gal	USEPA AP-42
OPERATING SCHEDULE	100	hrs/yr	
HEAT RATE	8533	BTU/KW-hr	
CONVERSION EFFICIENCY	40.0%	percent	
HEAT INPUT	35.84	mmBTU/hr	
DRY Fd	9190	dscf/mmBTU	USEPA Method 19
EXHAUST FLOW	1.17	mmdscf/hr	

EMITTENT NAME	EMITTENT PPM	CORR FACTOR	CTL EF LBS/UNIT	ACTUAL LBS/YR	ACTUAL TONS/YR	ACTUAL LBS/HR	RATE* g/kw-hr	RATE g/bhp-hr
Nitrogen Oxides (as NO_2)	372	1.0000	12.3460	5,185	2.59	51.85	5.600	4.176
Reactive Hydrocarbons (ROC) as CH_4	153	1.0000	1.7637	741	0.37	7.41	0.800	0.597
Carbon Monoxide (CO)	382	1.0000	7.7162	3,241	1.62	32.41	3.500	2.610
Sulfur Dioxide (SO_2)	0.3	1.0000	0.013	6	0.00	0.06	0.006	0.004
Particulates (as PM_{10}) (grains/dscf)	0.0111	1.0000	0.4409	185	0.09	1.85	0.200	0.149
Carbon Dioxide (CO_2)	4.87%	1.0000	1543.2439	648,162	324	6,482	700	522
Ammonia Slip (NH_3)								

* USEPA Tier 2 Standards (>560 kw)

NO_X + ROC = 6.4 g/kw-hr

CO = 3.5 g/kw-hr

PM_{10} = 0.2 g/kw-hr

CO_2 = 700 g/kw-hr (AP-42, Table 3.3-1)

Diesel Fuel Usage	26,152	gal/yr

Operating Emissions Summary

Stationary Source (FSRU)										
Qty.	Description	Rating (each)	Fuel	Annual Emissions, tons per year						
				NO_X	ROC	CO	SO_2	PM_{10}	CO_2	NH_3
3	Wartsila 9L50DF Main Generators	8250 KW	Gas / CA Diesel	13.3	20.6	18.0	0.07	7.7	54,279	5.5
1	Wartsila 9L50DF Backup Generator	8250 KW	Gas / CA Diesel	1.9	0.3	0.2	0.01	0.1	473	-
8	Sub-X Submerged Combustion Vaporizers	115 mmBTU/hr	Gas Only	48.9	3.5	148.9	0.33	3.8	215,271	-
4	Emergency Fire Pump / Generator	600 / 4200 KW	CA Diesel	3.0	0.4	1.9	0.00	0.1	370	-
3	Freefall Lifeboat	56 KW	CA Diesel	0.0	0.0	0.0	0.00	0.0	2	-
1	Diesel Fuel Storage Tank	145,000 gallons	CA Diesel	-	0.0	-	-	-	-	-
Total Emissions - Stationary Source (FSRU)				**67.2**	**24.8**	**169.0**	**0.41**	**11.8**	**270,395**	**5.5**

Vessels in Federal Waters										
Qty.	Description	Rating (each)	Fuel	Annual Emissions, tons per year						
				NO_X	ROC	CO	SO_2	PM_{10}	CO_2	NH_3
2	Tug Supply Boat	15,000 BHP Mains	Gas / CA Diesel	91.7	12.8	60.3	0.02	1.2	11,911	-
1	Crew Boat	1,500 BHP Mains	Gas Only	2.1	0.3	1.4	0.00	0.0	278	-
1	LNG Carrier	60,000 BHP Total	Gas / CA Diesel	69.2	9.6	45.5	0.01	0.9	8,984	-
Total Emissions - Vessel in Federal Waters				**163.0**	**22.7**	**107.2**	**0.03**	**2.1**	**21,173**	**-**

Vessels in District (State) Waters										
Qty.	Description	Rating (each)	Fuel	Annual Emissions, tons per year						
				NO_X	ROC	CO	SO_2	PM_{10}	CO_2	NH_3
2	Tug Supply Boat	15,000 BHP Mains	Gas / CA Diesel	0.73	0.10	0.48	0.00	0.01	95	-
1	Crew Boat	1,500 BHP Mains	Gas Only	0.41	0.06	0.27	0.00	0.00	54	-
Total Emissions - Vessel in District (State) Waters				**1.15**	**0.16**	**0.75**	**0.00**	**0.01**	**149**	**-**

All Project Elements							
Total Emissions - All Project Elements	NO_X	ROC	CO	SO_2	PM_{10}	CO_2	NH_3
Tons per Year	231.3	47.7	276.9	0.445	13.9	291,717	5.5
Tons per Day	0.63	0.13	0.76	0.001	0.04	799	0.01
Pounds per Day	1,268	261	1,517	2.4	76.0	n/a	29.9

6/1/2005